

WATER POSSIBILITIES FROM THE
GLACIAL DRIFT OF
GENTRY COUNTY

BY

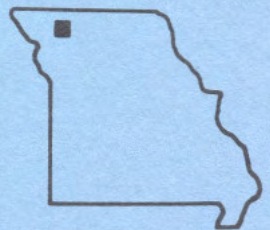
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Water Resources Report 7

WATER POSSIBILITIES FROM THE GLACIAL DRIFT
OF GENTRY COUNTY

by

Dale L. Fuller, J. R. McMillen, Harry Pick,
W. B. Russell, and Jack Wells



1956

STATE OF MISSOURI
Department of Business and Administration
Division of
GEOLOGICAL SURVEY AND WATER RESOURCES
Thomas R. Beveridge, State Geologist
Rolla, Missouri

WATER POSSIBILITIES FROM THE GLACIAL DRIFT OF GENTRY COUNTY

A special study of groundwater by the Missouri Geological Survey and Water Resources was made possible at the 1955 session of the Missouri Legislature. With the approval of the Governor, money was appropriated from the Missouri Post War Surplus Reserve Fund.

Since nearly two-thirds of the counties located north of the Missouri River are deficient in water supplies, much of the effort of this special study is being directed toward the problems of this area.

It has been shown that a program of test drilling can locate new reserves of groundwater. Potential areas are being tested so that additional supplies will be available for domestic, irrigation, industrial and municipal needs.

The most favorable areas are in the sand and gravel filled channels and valleys of pre-glacial and inter-glacial streams. Since these buried valleys do not conform to present day drainage patterns, a systematic program of test drilling is a principal means of locating the channels and mapping their extent. Such glacial deposits have proved to be excellent sources of groundwater.

QUALITY OF WATER FROM ROCK WELLS

The water from the consolidated rock formations which underlie Gentry County is, for the most part, mineralized. The following are analyses from water wells and oil tests:

CONSTITUENTS	IN PARTS PER MILLION					
	A	B	C	D	E	F
Turbidity	turbid	turbid	turbid	turbid	60	6
Odor					none	none
pH	8.4	8.5	7.6	7	7.6	7.2
Alkalinity (CaCO ₃)	274.0	132.0	206.5	313.0	292.5	294.0
Phenolphthalein	40.0	21.0	0.0	0.0	0.0	0.0
Methyl Orange	234.0	111.0	206.5	313.0	292.5	294.0
Carbonate (CO ₃)	24.0	12.6	0.0	0.0	0.0	0.0
Bicarbonate (HCO ₃)	285.4	135.4	251.9	381.8	356.9	358.7
Silica (SiO ₂)	27.3	23.7	11.3	13.0	15.2	15.7
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	3.7	3.7	2.6	9.0	2.0	2.3
Calcium (Ca)	26.9	67.7	92.2	66.5	124.2	510.6
Magnesium (Mg)	43.8	52.1	52.2	30.4	61.5	175.7
Sodium(Na)and Potassium(K)as Na	3608.6	3413.3	3144.6	1707.8	202.8	232.1
Total Manganese (Mn)					0.00	0.87
Total Iron (Fe)		8.24	9.0	0.03	8.16	0.43
Dissolved Iron					0.23	0.07
Precipitated Iron					7.93	0.36
Sulfate (SO ₄)	9.2	609.5	726.8	1389.3	588.7	1938.3
Chloride (Cl)	5512.5	4905.0	4418.0	1652.5	13.3	10.5
Nitrate (NO ₃)					1.0	0.1
Fluoride (F)					0.5	0.9
Total Suspended Matter					21.	0.
Total Dissolved Solids	9468.0	9208.0	8632.0	5091.0	1250.	3494.
Total Hardness	247.5	383.4	445.1	291.2	563.3	1998.2
Carbonate Hardness					292.5	294.0
Non-carbonate Hardness					270.8	1704.2
Percent of Alkalies	97	95	94	93	44	19

A. Owner: Palensky et al. J. M. Slagle and Son farm, NW 1/4 SW 1/4 NE 1/4 sec. 13, T. 64 N., R. 33 W. Total depth 1600 feet. The well penetrates into the Devonian System. The water was sampled July 27, 1947 from the base of the Kansas City group of the Pennsylvanian System at a depth of 390 feet. Analyst: M. E. Phillips.

B. As "A". Sample from the interval 1040-1045 feet, Cherokee group of the Pennsylvanian System. Collected August 8, 1947. Analyst: M. E. Phillips.

C. As "A". Sample from the interval 1145-1150 feet, Cherokee group of the Pennsylvanian System. Collected August, 1947. Analyst: M. E. Phillips.

D. As "A". Sample from the depth of 1600 feet (total depth), Devonian System. Analyzed July 9, 1948 by M. E. Phillips.

E. Owner: H. B. Allender, SW 1/4 SE 1/4 NE 1/4 sec. 20, T. 62 N., R. 31 W., total depth 212 feet. Sample collected August 1, 1956. Temperature of water 53° F., of the air 93° F. Analyst: M. E. Phillips.

F. Owner: Dave Jameson, SW 1/4 SE 1/4 SE 1/4 sec. 3, T. 61 N., R. 32 W. Total depth 200 feet. Sample collected August 1, 1956. Temperature of the water 57° F., of the air 87° F. Analyst: M. E. Phillips.

Referring to Plate 1, it will be noted that portions of Gentry are unfavorably located to obtain water from glacial drift. Wells drilled into consolidated rock to moderate depths may possibly obtain limited yields of water of usable quality.

QUALITY AND QUANTITY OF WATER FROM STREAMS

The streams of Gentry County, except for the Grand River, are intermittent in their flow. Minimum flow recorded of the Grand River at Gallatin (down stream from Gentry County) was but slightly more than 1000 gallons per minute. Though the quality of the water is satisfactory, the undependable flow makes the rivers unsuitable as a source of water for irrigation or for municipal use.

One water analyses is available. The sample was collected from the Grand River east of Darlington, sec. 11, T. 62 N., R. 31 W. At the time of sampling, November 22, 1955, stream flow was very low. The temperature of the water was 41° F., of the air 62° F. Analyst: M. E. Phillips.

CONSTITUENTS	IN PARTS PER MILLION
Turbidity	4
Odor	none
pH	8.1
Alkalinity (CaCO ₃)	181.0
Phenolphthalein	6.0
Methyl Orange	175.0
Carbonate (CO ₃)	3.6
Bicarbonate (HCO ₃)	213.5
Silica (SiO ₂)	6.4
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.8
Calcium (Ca)	59.7
Magnesium (Mg)	13.3
Sodium(Na) and Potassium(K) as Na	21.2
Total Manganese (Mn)	0.00
Total Iron (Fe)	0.31
Dissolved Iron	0.10
Precipitated Iron	0.21
Sulfate (SO ₄)	50.0
Chloride (Cl)	8.8
Nitrate (NO ₃)	0.0
Fluoride (F)	0.2
Total Suspended Matter	10.
Total Dissolved Solids	277.
Total Hardness	203.8
Carbonate Hardness	181.0
Non-carbonate Hardness	22.8
Percent of Alkalies	1

The following are stream flow data from: Bolon, Harry C., Surface Waters of Missouri; Missouri Geological Survey and Water Resources, 2d ser., vol. 34, p. 307, 1952.

Grand River near Gallatin, Daviess County

Location. - Water-stage recorder, lat. $39^{\circ} 55' 35''$, long. $93^{\circ} 56' 35''$, in SW $1/4$ NW $1/4$ sec. 16, T. 59 N., R. 27 W., at bridge on State Highway 6, 100 feet downstream from Chicago, Rock Island & Pacific Railway bridge, 1 mile northeast of Gallatin and 6 miles upstream from Honey Creek. Datum of gage is 712.56 feet above mean sea level, datum of 1929.

Drainage Area. - 2,250 square miles.

Records Available. - June 1929 to September 1949.

Average Discharge. - 28 years, 1,103 second feet.*

Extremes. - 1921-49: Maximum discharge, 69,100 second-feet June 24, 1947; maximum gage height, 37.02 feet June 2, 1929 (present site and datum); minimum discharge, 2.4 second feet October 24, 25, 1939. Maximum stage known, about 40 feet July 8, 1909, from floodmarks.

Revisions. - The maximum discharge and gage height for the water year 1926 have been revised to 53,200 second-feet September 17, 1926 (gage height, 36.80 feet) superseding figures published in "Water Resources of Missouri, 1857-1926" Vol. XX, Second Series.

Remarks. - Records fair to good except those for periods of ice effect and no gage-height record, which are poor.

Cooperation. - Station maintained by Surface Water Branch of the U. S. G. S. in cooperation with Corps of Engineers. Gage-height record collected in cooperation with U. S. Weather Bureau.

* One second-foot equals 448.83 gallons per minute.

QUALITY OF WATER FROM GLACIAL DRIFT

In general, the water from the glacial drift is high in total iron, total dissolved solids, and sulfates. The iron content in the water may cause staining of plumbing fixtures and laundry; however, relatively inexpensive water treatment for the iron will prevent this staining. For most types of irrigation, total dissolved solids should not exceed 2000 parts per million and total alkalies should not exceed 75 percent. Most people cannot tolerate water for drinking purposes which contains more than 1500 parts per million of chloride, or 2000 parts per million sulfate.

Water with 300 parts per million of chloride tastes salty to some people. Sulfates in excess of 500 parts per million may have a laxative effect when first used for drinking.

The following are analyses from ten glacial drift wells:

CONSTITUENTS	IN PARTS PER MILLION				
	1	2	3	4	5
Turbidity	10	clear	iron pp't	slight	slight
Odor	none	none	none	none	musty
pH	7.45				
Alkalinity (CaCO ₃)	258.5	310.8	287.7	323.2	283.4
Phenolphthalein	0.0				
Methyl Orange	258.5				
Carbonate (CO ₃)	0.0	8.3	6.9	4.0	0.0
Bicarbonate (HCO ₃)	315.4	362.2	350.8	394.1	345.6
Silica (SiO ₂)	7.8	19.6	18.8	21.2	18.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	1.5		0.77*	0.19*	1.31*
Calcium (Ca)	117.1	86.2	77.8	263.9	86.1
Magnesium (Mg)	38.5	34.6	31.4	50.0	33.5
Sodium(Na)and Potassium(K)as Na	405.2	320.7	307.5	250.5	277.6
Total Manganese (Mn)	0.00				0.07
Total Iron (Fe)	2.22		2.30	2.17	2.20
Dissolved Iron	0.54	0.95	0.30	0.15	0.20
Precipitated Iron	1.68		2.00	2.02	2.00
Sulfate (SO ₄)	895.1	517.0	417.3	604.0	498.1
Chloride (Cl)	84.3	129.0	158.0	275.1	137.2
Nitrate (NO ₃)	0.2	0.20	2.25	0.28	2.01
Fluoride (F)	0.5				0.60
Total Suspended Matter	0.		62.8	10.2	15.2
Total Dissolved Solids	1724.	1333.0	1323.0	1847.0	1349.0
Total Hardness	275.5	357.4	323.2	864.8	352.6
Carbonate Hardness	258.5	310.8	287.7	323.2	283.4
Non-carbonate Hardness	17.0				
Percent of Alkalies	66	66	67	39	63

* Al₂O₃ only

CONSTITUENTS	IN PARTS PER MILLION				
	6	7	8	9	10
Turbidity	clear	1	1.0	10	30
Odor	none	none		none	none
pH		7.2	6.9	7.5	7.5
Alkalinity (CaCO ₃)	295.5	344.0	341.0	350.0	404.5
Phenolphthalein		0		0.0	0.0
Methyl Orange		344.0		350.0	404.5
Carbonate (CO ₃)	0.0	0		0.0	0.0
Bicarbonate (HCO ₃)	360.4	419.0	415.2	427.0	493.5
Silica (SiO ₂)	16.0	24.0	26.0	16.5	9.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.99*			1.5	1.8
Calcium (Ca)	91.4	119.6	118.9	79.1	44.3
Magnesium (Mg)	35.9	46.7	45.2	25.5	18.0
Sodium(Na)and Potassium(K)as Na	274.8	291.4	271.1	104.4	177.0
Total Manganese (Mn)	0.08			0.00	0.00
Total Iron (Fe)		0.16	0.5	2.40	3.10
Dissolved Iron	0.15			0.10	0.62
Precipitated Iron	none			2.30	2.48
Sulfate (SO ₄)	479.4	588.4	575.9	137.8	114.4
Chloride (Cl)	139.6	123.2	99.3	10.3	16.8
Nitrate (NO ₃)	0.68	27.9	30.1	0.1	0.1
Fluoride (F)	0.35			0.4	0.5
Total Suspended Matter				0.	7.
Total Dissolved Solids	1249.0	1475.0	1470.0	618.	629.
Total Hardness	375.7	491.0	483.0	302.4	184.7
Carbonate Hardness	295.5	344.0	341.0	350.0	184.7
Non-carbonate Hardness		147.0	142.0	0.0	none
Percent of Alkalies	61	56	55	43	68

* Al₂O₃ only

1. Owner: Reeves Nicholson, NE 1/4 NE 1/4 NW 1/4 sec. 3, T. 63 N., R. 31 W. Total depth 221 feet. Temperature of water 54° F., of the air 74° F. Sampled October 5, 1956. Analyst: M. E. Phillips.
2. Owner: City of Albany well No. 3, SE 1/4 SE 1/4 sec. 24, T. 63 N., R. 31 W. At the time of analyses, December 31, 1929, this well was furnishing the city with water. Total depth 197 1/2 feet. Analyst: R. T. Rolufs.
3. As "2". Analyzed June 23, 1931, by R. T. Rolufs.
4. As "2". Analyzed June 14, 1934, by R. T. Rolufs.
5. Owner: City of Albany "Deep City well #4". Collected July 2, 1935. Analyst: R. T. Rolufs.
6. Owner: City of Albany, wells number 5 and 6. Analyzed April 6, 1937, by R. T. Rolufs.
7. Owner: City of Stanberry. Sampled direct from "old wells" November 19, 1953. Analyzed by Missouri Division of Health.
8. Owner: City of Stanberry. Sampled from "new well" August 25, 1955. Analyzed by Missouri Division of Health.
9. Owner: C. R. Newman, SE 1/4 SE 1/4 NW 1/4 sec. 3, T. 62 N., R. 30 W. Total depth of well 178 feet. Sampled July 30, 1956. Temperature of the water 64° F. (sampled from pressure system), of the air 89° F. Analyst: M. E. Phillips.
10. Owner: John W. Patton, NW 1/4 NE 1/4 NW 1/4 sec. 20, T. 62 N., R. 30 W. Total depth of well 153 feet (?). Sampled from pressure system October 5, 1956. Analyst: M. E. Phillips.

QUANTITY OF WATER FROM GLACIAL DRIFT

DOMESTIC WELLS - Included in this category are wells developed for household or general farm use. Yields required from domestic wells vary but seldom exceed 15 gallons per minute. In some parts of Gentry County sands and gravels were not deposited in the glacial drift. There are also areas where the glacial drift cover is relatively thin or lacking. In such areas the possibility

of developing wells is limited. Plate 1 shows the area most favorable for the development of domestic wells. Plate 3 is a contour map showing the elevation of bedrock above sea level. To determine probable drilling depths, the elevation of the bedrock should be subtracted from the surface elevation for each specific site. Plate 3 also shows the locations of the test holes and the thickness of the glacial drift encountered.

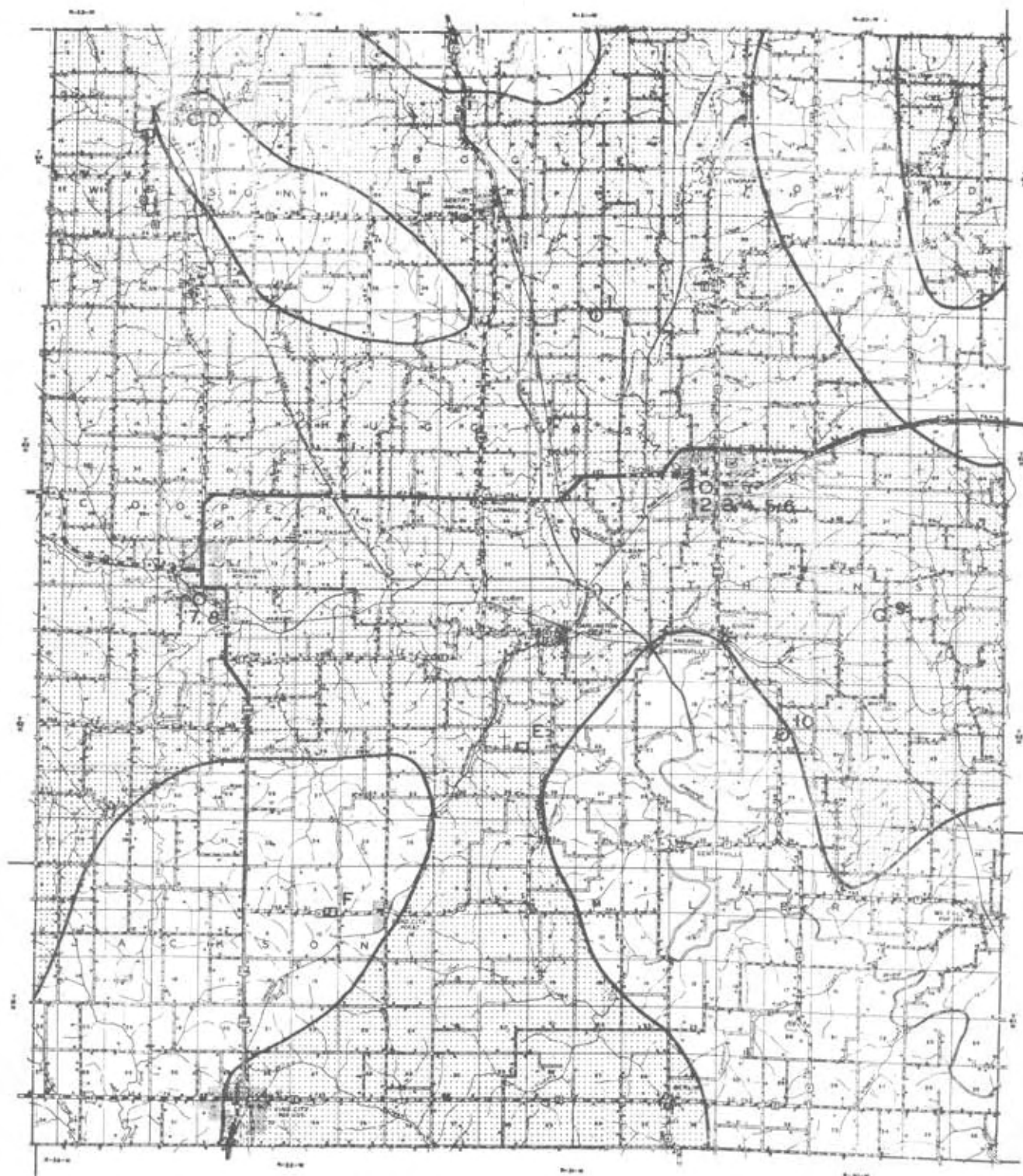
IRRIGATION WELLS - Included in this category are all high yield wells whether used by cities, by industries, or for irrigation. Plate 2 shows the area most favorable for the development of irrigation wells. Also shown are the locations of two wells which flowed and the location of the well for which sieve analyses were made of the sands. The results of the sieve analyses are shown on Plate 4.

With proper development, yields of 200-1000 gallons per minute may be obtained. This is an estimate and is not based upon actual pumping tests within the area. Yields to be expected are contingent upon several factors:

- (1) The thickness of the sand and gravel beds.
- (2) The size and sorting of the sand and gravel.
- (3) The manner of construction and materials used, such as proper well screen, gravel pack, etc.
- (4) Ability of the well driller to develop the full capacity of the water bearing sands.

Continued successful production is contingent upon:

- (1) Re-charge rate of the water-bearing horizons.
- (2) Quality of the screen and materials used.
- (3) Subsequent well treatment such as acidizing.
- (4) Avoidance of over-pumpage.



LEGEND

Base by the Missouri State Highway Department, 1950



Area most favorable



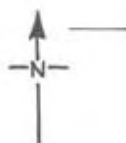
Location of wells in drift from which water was analyzed



Water sample analyzed from a rock well



Water sample analyzed from a stream



MAP OF GENTRY COUNTY SHOWING

AREA MOST FAVORABLE FOR THE
DEVELOPMENT OF WELLS IN DRIFT

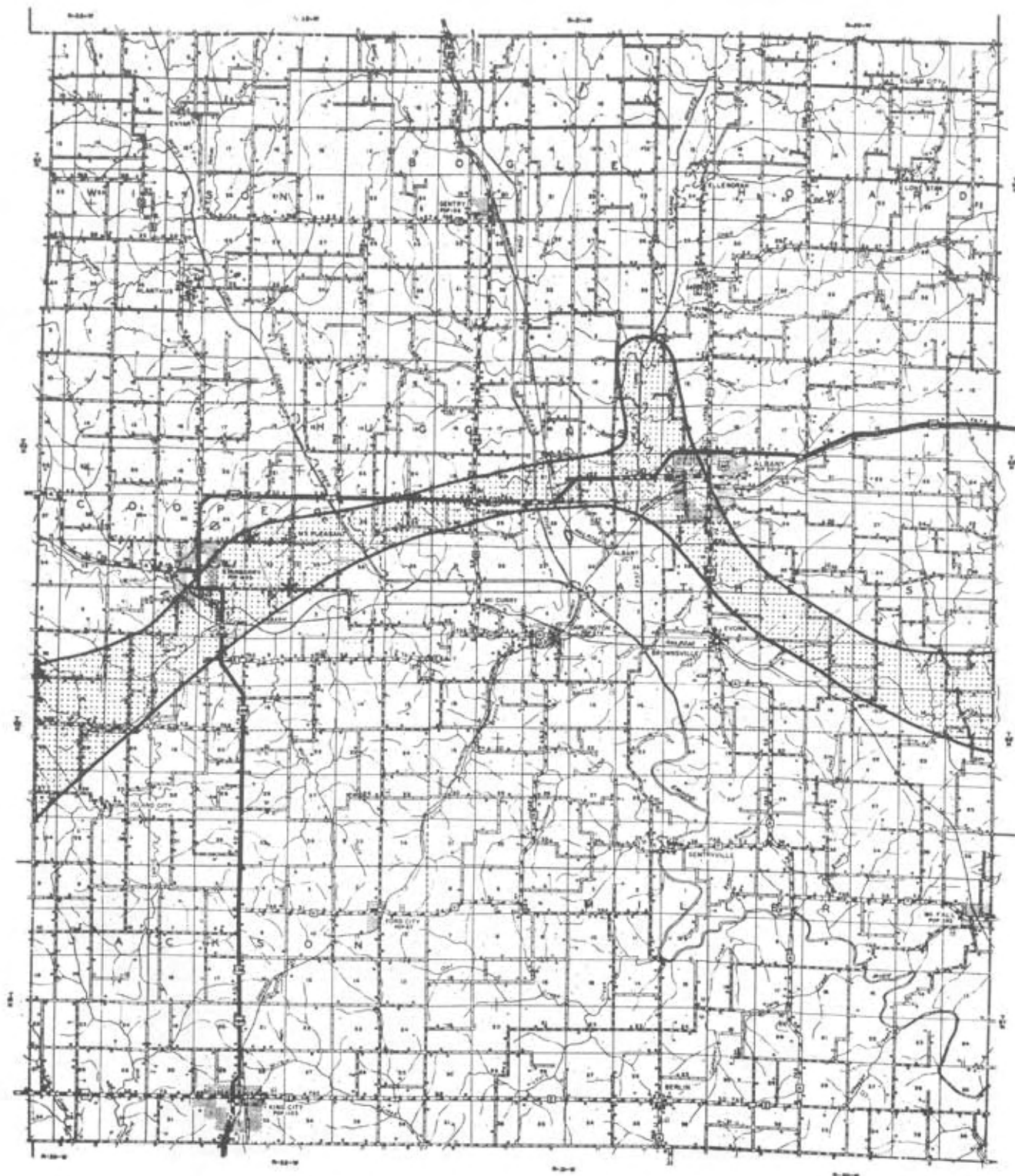
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W.B. RUSSELL J.S. WELLS

1952

MISSOURI GEOLOGICAL SURVEY
AND WATER RESOURCES
ROLLA, MISSOURI

THOMAS R. BEVERIDGE
STATE GEOLOGIST



Base by the Missouri State Highway Department, 1950

LEGEND



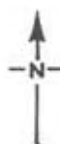
Drift filled valley



Test wells that flowed



Sand analysis from this well
shown on plate four.



MAP OF GENTRY COUNTY

SHOWING

DRIFT FILLED VALLEY IN WHICH
IRRIGATION WELLS POSSIBLY CAN
BE DEVELOPED

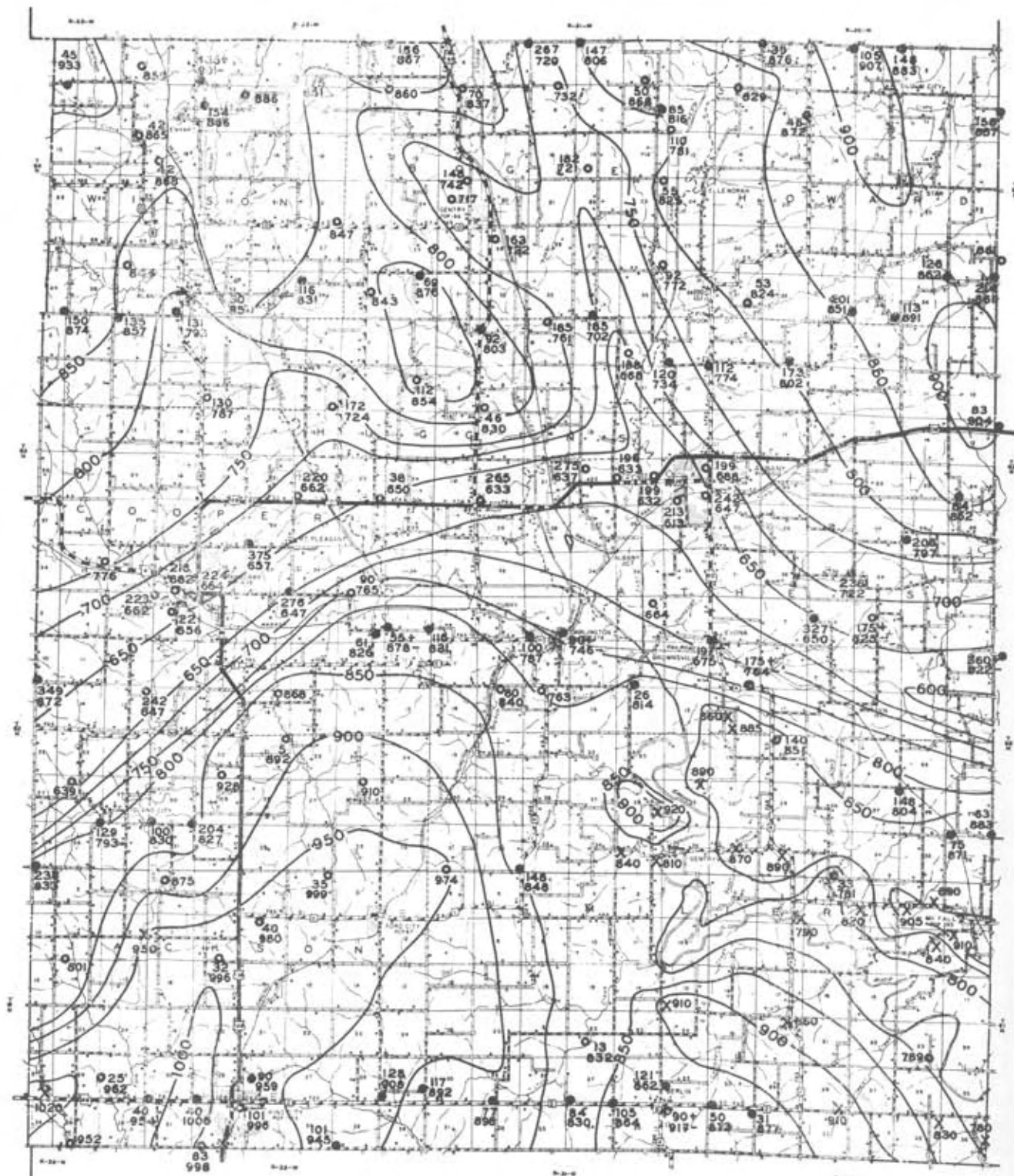
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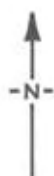
THOMAS R. BEVERIDGE
STATE GEOLOGIST



Base by the Missouri State Highway Department, 1950

LEGEND

- 135
650 Test holes showing thickness in feet of drift and elevation of bedrock above sea level.
- Water wells
- X Bedrock Outcrops
- * Mine or Quarry
- Contour interval 50 feet

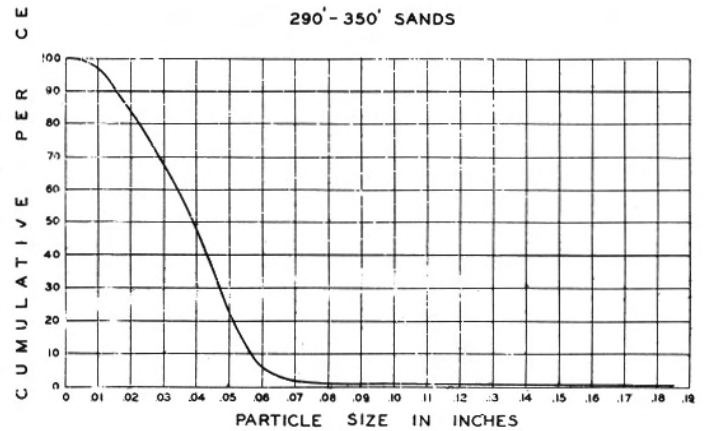
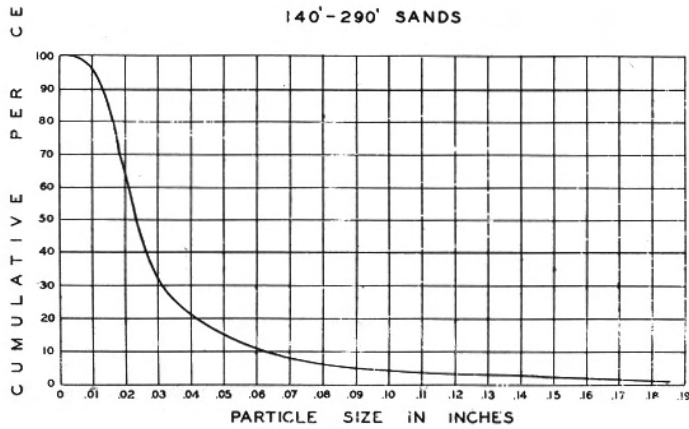
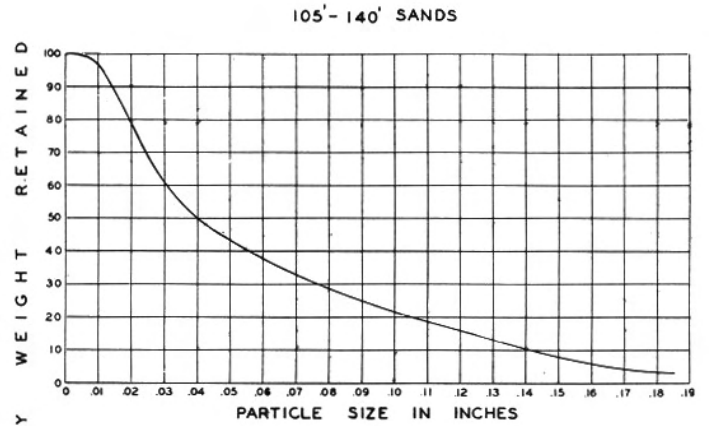
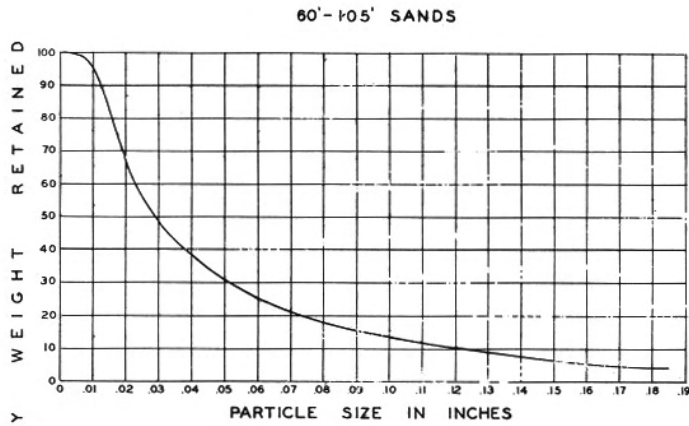


CONTOUR MAP OF GENTRY COUNTY SHOWING BEDROCK ELEVATIONS BY

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MISSOURI GEOLOGICAL SURVEY
AND WATER RESOURCES
ROLLA, MISSOURI

THOMAS R. BEVERIDGE
STATE GEOLOGIST



SIEVE ANALYSES OF SANDS

FOUND AT VARIOUS DEPTHS IN

TEST WELL N° 324

SW¼ SW¼ SE¼ SEC.10, T.62N., R.33W., GENTRY CO. MISSOURI

DALE FULLER, OCTOBER, 1956

MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES

THOMAS R. BEVERIDGE, STATE GEOLOGIST

SUMMARY

Approximately 20,000 acres of Gentry County are located within the area in which irrigation wells possibly can be developed. Nearly two-thirds of Gentry County's area is suitably located for obtaining water sufficient for domestic needs from the glacial drift.

Questions concerning water problems for a specific location should be sent to the Missouri Geological Survey, Rolla, Missouri.